

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, D.C. 20554

In the Matter of (

(

Amendment of the Commission's Amateur Radio ( RM-\_\_\_\_\_

Rules... Adding A Tyro License Class... (

Structuring A Portion of Amateur 70cm (

Band... Local Coordinating Committees... (

Insuring Amateur Radio As The Primary User (

on 430-to-440 MHz... And, Adding Scientific (

Research To The Purpose Of Amateur Radio. (

To: The Commission

**PETITION FOR RULE MAKING**  
(submitted August 13, 2017)

**Section 0: PETITIONER INTRODUCTION**  
(for Gary A. Hampton)

0.1 I was first licensed as an Amateur Radio Operator and First Class Radiotelephone Operator around 1970 (WB8IIY & P1-19-23832). I currently hold an Extra Class Amateur License, a commercial General Radiotelephone Operator License and a General Mobile Radio Service License (AD0WU, PG158282, WQYS696). In past years, I have held several others in Part 5, Part 90, Part 95 and Part 97.

0.2 After working for a Detroit based General Electric two-way radio shop, then moving West to run my own land mobile radio business, I consulted with Dale N. Hatfield Associates (Boulder, Colorado). There, I specializing in land mobile radio issues before

the Commission.

0.3 Currently, I manage Hampton Technologies, Inc. We build custom scientific instrument systems. Scientific investigations often use radio. I have published peer reviewed reports about these systems in various scientific journals. In the 1990s I was a Senior Research and Development Engineer at the National Center for Atmospheric Research (NCAR), Boulder, Colorado, where I was responsible for instrument system development.

0.4 Since the early 1980s, I have been part of many past Commission actions, including: 82-10, 85-192, 87-172, 10-106, 10-119. I have written numerous articles for Land Mobile trade magazines. A more complete Resume and my business interests can be found at my website: [WWW.2HTI.com](http://WWW.2HTI.com)

0.5 Pursuant to the Commission's rules, I hereby respectfully request that the Commission issue a ***Notice of Proposed Rule Making*** at the earliest possible date, proposing to amend its rules consistent with the instant Petition.

0.6 As the Commission is well prepared to codify the specific form and language required to make its rules conform to the concepts herein, the petition does not presume to substitute for the Commission's judgment in this matter.

## **Section 1, A SYNOPSIS OF MAJOR PETITION FEATURES**

1.1 A new "*Tyro*" class (entry-level) Amateur License issued to persons having reached the age of eleven years. Tyro is a Latin derivative meaning "*new recruit*." A major purpose of this Petition is to double the size of Amateur Radio with new recruits... broader interests, younger people, better nurture, more public service. The Tyro License allows Amateur Radio to do even more by first reducing its barrier-to-entry. The Petition starts by returning Technicians to a mid-level license with a stronger more culturally relevant roll. Since all new recruits need mentors, Tyros will benefit from skills some techs took to their first radio class... skills these classes folded into the radio art... skills even the extra class exam does not test. In short, we already have Technicians with noteworthy leadership, didactic and social skills. We need to give them more responsibility, not less respect.

1.2 The Tyro License is issued after passing a short on-line test proctored by a Ham mentor (Technician or higher). On-line is how one gets a GMRS license now. The Tyro License would just add a few more questions... and, get a commitment to tutor the new recruit toward becoming a polished Ham. This does not change the current VEC testing for higher class licenses (Volunteer Examiner Coordinator).

1.3 Test questions are about radio etiquette and usage rules (the physics comes later). The fact that there is mentoring resists the "dumbing-down" effect. Mentoring is always a path from "meeting

people where they are" to helping them find new vision for their lives. For radio, only hams offer this. There is no learning structure in FRS, MURS, CB and GMRS. Tyro is not about dumbing-down, it is about lifting up.

1.4 Tyros (and all Amateur Licensees) can use 99, (2.5 kHz deviation, 12.5 kHz spaced) analog FM repeater/simplex channels located on our 70 cm band. These channels are numbered from 1-99. These channels are called the ***TyroSubBand. Interoperability is a major priority for this Sub-Band.*** Here, the Commission only sets the framework; Amateur Radio manages the detail within that framework. These are the only frequencies upon which the Tyro Class License may transmit without supervision.

1.5 Channels 1-79 are duplex pairs used for repeaters. Their inputs are 9 MHz lower in frequency than their outputs. This allows compact, less expensive, more robust duplexers. Tyros may use repeaters but cannot be the licensee for a repeater.

1.6 Channels 1-64 are repeater pairs requiring coordination. They are strategic wide-area complex systems located at known fixed locations. They often cover major cities and major highways and seldom move. Interference among coordinated systems must be resolved by all of the region's coordinating committees.

1.7 Channels 65-79 are repeater pairs not requiring coordination. They may be remote, temporary, or experimental systems. While they are somewhat less restricted, their most important distinction is that they are not protected by coordination.

1.8 Channels 80-99 are unpaired simplex only channels. They too, are uncoordinated.

1.9 Repeater output frequencies can also be used for simplex ("TalkAround"). TalkAround activity must not interfere with repeater traffic. Repeater input frequencies may not be use for simplex.

1.10 These 99 channels occupy only 2.25 MHz. (7.5%) of 70 cm... the bottom 1 MHz and the top 1.25 MHz of 430-440 MHz.

1.11 TyroRadios have restrictions... 20 Watts, restricted remote control. Tyros may use more advanced radios with adequate supervision.

1.12 Tyro traffic may also be retransmitted beyond the TyroSubBand (example, 70cm-to-2meter cross-band or linked repeaters). The frequencies used for these repeated transmissions are limited to the frequencies and modes permitted to the repeater licensee. This extends the scope of Tyro traffic without their being technically responsible for the transmissions.

1.13 On this small sub-band, the Commission establishes: center frequencies, emission bandwidth, repeater splits and a voice priority.

1.14 The voice priority does not exclude two digital channels created by splitting the base-band's audio spectrum. One can be used for data even when voice is present. In the other, data is substituted for voice when appropriate.

1.15 The low audio frequency channel - called the **ToneChannel1** - uses audio spectrum from 40-to-200 Hz. and carries CTCSS or slow data

(see 4.60).

1.16 The other – called the **VoiceChannel** – uses audio spectrum from 300-to-3000 Hz. and carries voice or faster data (also 4.60).

1.17 Digital transmissions must use **OpenArchitecture** coding techniques, specifically: public domain specifications, no required agreements, no royalties. This promotes interoperability while it resists *de facto* encryption. While OpenArchitecture does not prevent encryption, it does makes it more obvious.

1.18 Station identification can use voice, Morse Code or the same OpenArchitecture digital technique transmitting the data traffic.

1.19 Repeaters on the TyroSubBand must be "open"... available to all licensed amateurs that honor the usage rules established by the repeater licensee together with their Committees.

1.20 To guarantee nationwide interoperability, all repeaters must use one of three OpenAccessCodes, which are these CTCSS tones: 67Hz, 79.7hz and 97.4Hz. While repeaters may respond to multiple tones or even sub-audible data, one of the set must be an OpenAccessCode causing the repeater to repeat voice traffic. These tones are chosen because they can be modulated to carry data without interfering with simultaneous voice... MSK, PSK, QPSK, etc. Digital squelch and E.F. Johnson's LTR trunking already use similar techniques (see also 4.66).

1.21 Thus, both CTCSS and slow data can be transparently supported without perturbing VoiceChannel traffic (see also 4.75).

1.22 Tyro rules establish an UrgentCall tone sequence meant to activate muted monitoring receivers. UrgentCall uses three DTMF characters in this combination: \*#\*. Unnerved users strike four alternating keystrokes (\*## or ##\*). They need not remember the order. Unwitting decodes are unlikely. DTMF is nearly standard on commercial radios (see also 4.33).

1.23 Amateur Radio is secured as the primary user on all of 430-to-440 MHz. This protects a nation wide build-out of CERT/ARES systems (Community Emergency Response Teams / Amateur Radio Emergency Services). The Tyro License is exceptionally important to FEMA's CERT program. It allows ARES to solve CERT's communication problems. The TyroSubBand technical specifications easily double the capacity of typical 70cm amateur repeaters when measured on the basis of Erlangs per Hertz per hectare (E/H/h). This Rule Making facilitates exigent radio communication services nonexistent today and it does this with little risk on almost vacant spectrum. In a decade, ARES/CERT could build interoperable TyroSubBand repeaters distributed nationwide along major highways and covering population centers. Such a plan augments emergency radio with a network not threatened by some contemporary failures modes. It adds peak capacity and a more ubiquitous connection to citizen response teams. In short, the plan makes the entire emergency radio infrastructure less vulnerable and more capable. **Amateur Radio and CERT can do this.** It might be useful for Congress to insure Amateur Radio's access to interstate medians.

1.24 Amateur Radio shares 420-to-430 MHz and 440-to-450 MHz just as it does now.

1.25 Public Domain scientific research is explicitly added to amateur radio's purpose. This broadens ham radio's scope of interest and allows it to contribute more fully in one of Humankind's most transcendent ventures.

1.26 Using democratic processes, local licensees form one or more committees – for regional spectrum management – to establish appropriate local repeater usage rules – to evaluate TyroSubBand radio efficacy.

1.27 Repeater licensees together with their local committee[s] set usage rules for their repeater. Committee[s] and the repeater licensees also set guidelines for TalkAround use on coordinated repeater output frequencies... use, not preclusion.... CTCSS tones, priority traffic protocol, etc.

1.28 For coordinated repeaters, Committees publish: repeater usage rules, repeater location, repeater HAAT, repeater ERP, repeater OpenAccessCodes and repeater operational status... all published on a website (see also 4.66).

1.29 Regional committees resolve interference, permissible communications, pecuniary interest and technical radio efficacy issues.

1.30 The Commission only steps in when local committee resolution fails.



## Section 2: DELIBERATION PROLOGUE

2.1 Radio spectrum capacity is not consumed by use. It is consumed by time itself. Said another way, regardless of whether spectrum carries traffic or not, its potential is diminished by the passage of each second. Arguably, **vacancy** is the worst **utilization** of radio spectrum.

2.2 Yet, some vacancy is essential. Without it there is no good entry point for spectrum usage. Ideally, there would always be just enough vacancy to provide timely access to spectrum innately suitable to the need. Otherwise, vacant spectrum is a tenable waste.

2.3 Innately suitable spectrum is not an infinite resource... not at specific space-time coordinates. Thus, when there is a plurality of users, demands will eventually be contested and disputed. Optimal sharing obviously calls for dispositive priority management schemes.

2.4 Within a century of James Clerk Maxwell's profound 1865 revelation, the United States Congress established the Federal Communications Commission (FCC) to codify radio spectrum management for our national community. This stewardship role is not the Commission's alone; we all share it.

2.5 Our stewardship challenge is to find rules that maximize radio spectrum's potential benefit for our community, without thwarting needs... and, without useless vacancy.

### **Section 3: DELIBERATION**

#### ***What justifies current amateur spectrum?***

3.1 Attempts to take even more spectrum from Amateur Radio will emerge from issues related to the statement above. The value of spectral demands are always pitted against ham radio with priorities set within community need.

3.2 Few things tempt people touting new radio ideas more than vacant spectrum. They may say: "Amateur Radio's time has passed." "Other things are taking its place." "It is slowly dying." "Their vacant spectrum need to be reallocated to more useful contemporary purpose."

3.3 These things have been said. Ham spectrum has been reallocated. To be fair, we have gained much valuable spectrum too. On balance, ham radio has been fairly treated... but, the contest is always nigh.

3.4 In the face of unmet radio demand these choices seem valid: (1) reallocate underused spectrum, (2) share partially used spectrum among user groups or, (3) expand the permitted use for current occupants.

3.5 This Petition pursues the third choice for the reasons presented herein. Amateur Radio can do more. They want to do more. Currently, there are several culturally driven spectrum needs. The Commission could respond by taking pieces of ham spectrum and moving the parcels toward these needs or allowing ham radio to incorporate the needs into their community. This Petition is about encouraging

Amateur Radio to expand its scope. One ambit with amplification potential is science.

### ***A Case for Science***

3.6 While emergency communication is an obvious Amateur Radio priority, scientific research is virtually ignored. Later, the Petition returns to public safety but, the instant exegesis focuses on the wisdom of including scientific research in Part 97.1 of the Commission's Rules (Amateur Radio's purpose).

3.7 The purpose of science is to understand reality well enough to accurately predict how it responds to change agents. When Humankind adds an ethical component to this knowledge, it becomes wisdom or sapience.

3.9 Politics and religion both use sapience to change reality. For millennia, we have used and refined sapience to our benefit. Taxonomist Carl Linnaeus used *Homo sapiens* to define us. No other human endeavor contributes more to our well-being than sapience. No other human endeavor is more vexing than wedding knowledge to ethics. Notwithstanding, the process depends on science.

3.10 Even a casual look at our species' current cultural phylogeny must see technological explosion. Science is profoundly changing our lives in ways no one predicted. The *slew-rate* of technological change is not moderating, it gets steeper. It seems intuitively obvious that some significant fraction of us needs to keep pace with these technological changes. While ham radio already

plays that roll. Explicitly including science in Amateur Radio's purpose can inspire even more needed focus on the science.

3.11 The notion that public good is at the core of Amateur Radio is an undisputed platitude. Authentic discussion must begin with less banality. Purpose statements too broad would lose focus and, perhaps, even encourage mischief... but, statements too narrow might miss opportunity. The Petition's premise is that **careful inclusion** of scientific investigations in Amateur Radio's purpose is a present-day opportunity and poses almost no risk

3.12 Scientific investigations divide into two camps: disjunctive research is oriented toward discovery with an obvious chance of quickly spawning a profitable venture; transcendent research is oriented toward more fundamental discovery with less obvious opportunity and no promised result.

3.13 Funding disjunctive research is often easier than funding transcendent research. Had Maxwell not been funded by Scottish educational institutions and his own inherited wealth, he might have failed to write A Dynamic Theory of the Electromagnetic Field. Yet, 150 years later, venture capitalists stumble over one-another to finance disjunctive ventures based on his transcendent research... research Maxwell funded with exiguous resources.

3.14 The truism here helps refine Amateur Radio's purpose as it relates to transcendent science: ***Amateur Radio should be used to further scientific research that is published and quickly placed into the public domain.*** Disjunctive scientific research has other

spectrum. Such an addition encourages Amateur Radio to contribute even more to Humankind's most valuable venture... our search to understand and modify reality to benefit us all.

### ***Why this Petition now?***

3.15 Starting with a small piece, one goal of this Petition is easy reliable nationwide **70 cm repeater** interoperability... repeaters ready for both exigent and casual communications... repeaters and networks of repeaters adroit enough for: demanding emergencies, pursuing communal goals, assisting interstate travelers and spreading goodwill though simple companionship. Already, Amateur Radio does this fairly well. Even so, some spectral efficiency, efficacy and access issues remain. The Commission could help by coaxing progress, by adding modest structure and, by allowing more access... as only they can.

3.16 Pragmatically, the proposed band structure would reduce "road-trip research." Travelers would quickly find local repeaters. They would always be on the same channel pairs and their access codes are obvious. Standardized radios could scan for activity.

3.17 More significantly, the plan proffers techniques doubling spectral capacity. For a start, this Petition challenges the *status quo*. It would profoundly change aspects of our hobby. In the end, it also affects Amateur Radio's place in our culture.

3.18 The proposed rule change would reorganize and implement

more capable and efficient technologies. These technologies and techniques would yield both serviceability and capacity. Further, the proposal does this without "trashing" the installed base.

3.19 When some would say: "we do not need more capacity... our repeaters are too quiet now," they augur a significant ham radio issue.

***Ham radio should be growing faster.***

3.20 We are quick to tout a decade of eight percent amateur growth while ignoring simultaneous ten percent U.S. population growth. In other words, growth notwithstanding, ham radio is a smaller portion of the population today than at the turn of the millennium. Fewer than one in four hundred people are hams.

3.21 This slight shrinkage happened despite unprecedented relevance. Humankind has never been so dependent on radio. Further, ham radio is a quintessential science hobby. Our scope overlaps: astronomy, computers, hunting, fishing, biology, model airplanes, rock-climbing and maybe even golf or microscope building. Clearly, the list goes on.

3.22 As our hobby pursues the purpose enshrined at Part 97.1, it gives extroverts and introverts alike what they want from community, what they want for their intellect, and what they want in their personal growth. With more significance, more leisure time, and more wealth than ever before, our hobby should be **growing faster** than our population. Why the paradox?

3.33 While this narrative is not the whole story, it is a part. In my years as a Boy Scout ham radio merit badge instructor this is what I saw: About the time young people finish elementary school many are drawn to ham radio. Most often, a large fraction of young scouts "sign-up" for the ham class. Yet, just as this precious spark is kindled, we frustrate it. Unwittingly, we tell the kids they are not worthy... not good enough for our private club.

3.34 Even today's technician test is too advanced for most Boy Scouts. By high-school, yes. Certainly by college, anyone wanting to be a ham could likely pass the test but, some preteen enthusiasm opportunity is needlessly lost.

3.35 A goal of this Petition is to tell virtually all that choose our path, they are valued. They are important enough for us to help them start their journey now. To this end, the Petition adds an entry level Amateur License, the **Tyro** class. [**Tyro** is a Latin derivative meaning: *new recruit*.]

***The Tyro license will spawn growth.***

3.36 Amateur radio suffers a barrier few hobbies must. **The test.** Many hams quickly react by saying the test prevents the "dumbing-down" of ham radio. Testing rigor keeps ham radio from becoming "CB" radio with more spectrum. While that attitude is not entirely wrong, a second look reveals a more comprehensive vision. The Petition's plan has little risk of soiling our hobby.

3.37 When the code barrier was superannuated, our fraction of advanced licensees increased. Defensibly, code's demise actually

promoted the science part of amateur purpose. While the need for individual operators using Morse Code has not vanished, its significance is reduced by digital technology and systemic communications.

3.38 While time and technology reliably changes most things, the common thread of all five ham purpose principles has not changed. Amateur Radio is still about humans exchanging information using radio spectrum. Yet, technological and cultural evolution has changed how we pursue this purpose. The technological forcing factors are obvious. The Petition will address cultural issues several times.

### ***Tyros Get A License On-Line***

3.39 The Tyro Petition restructures the test regiment and a bit more. It sets the Tyro minimum age to eleven. It reduces the entry level testing to "on-line" questions about ham radio etiquette and usage rules. It limits Tyros to repeater and simplex operation in a sliver of 70 cm. It requires a promise, from a Technician or higher licensee, to coach the new recruit.

3.40 "Back in the day", this change would have generated thousands of new hams from the Boy Scouts alone. There is even more potential today. Our culture has discovered that girls have abeyant technical proclivity just as ham radio becomes more gender inclusive. More rookies of both genders means more success toward our purpose... the same purpose that entrusts us with so much wonderful spectrum. More success helps us justify that trust.



3.41 This idea cannot present much risk. The Family Radio Service (FRS), the Citizens Band Radio Service (CBRS), the Multi-Use Radio Service (MURS) and the General Mobile Radio Service (GMRS) have no tests at all. Of the four, only GMRS is even licensed. Unlike Amateur Radio, these other services provide nothing guiding their neophytes.

***Citizen Corps Councils, CERT and ARES...***

3.42 Many regions in the United States have organized Community Emergency Response Teams (CERTs) using community volunteers managed by a Citizen Corps Council under the Federal Emergency Management Agency (FEMA) part of the Department of Homeland Security (DHS). These CERT teams need radio communications. While they often use GMRS, FRS and MURS radios, a computer search can quickly find ideas requesting radio spectrum dedicated to CERT needs. [This is cultural evolution.]

3.43 Having their own spectrum will not solve their problem. CERT needs more. They need systems designed for their type of communication... *one-to-many* (party-line) conversations heard over expansive local areas by a plurality of volunteers. They need reliable low-cost radios that lightly-trained volunteers can use. They need highly-trained volunteers, prepared to build and maintain these systems. They need experts to manage their communication process.

3.44 They need Amateur Radio Emergency Service (ARES). ARES has it all. They bring the spectrum with ready and reliable low cost

radios. They bring the system builders and maintainers. They bring the communication and training experts. They bring new CERT volunteers. They bring relationships with local public safety organizations. They even bring the starting repeater systems that could quickly be adapted to CERT use.

3.45 What Amateur Radio does not bring is an FCC radio license almost as easy to get as the GMRS license. This Petition solves that. It makes entry almost as easy as GMRS, while leaving the current advance-class rigor in place.

3.46 Collaboration between CERT and Amateur Radio offers a renewed vision of the possible. With ham volunteers and painless government support, Tyro class repeater systems could cover every city and every major highway in the United States within a decade. Such systems could also encompass parks, forests and even a few trout streams. The one-to-many characteristic of ham repeaters can bring help much faster than a cell phone. On mundane days, people could just enjoy talking to one another.

3.47 Including CERT volunteers as Tyro Licensees may not substantially increase the pursuit of radio technology, but it is likely to increase the capacity to communicate priority information. This will not be dumbing-down Amateur Radio.

***What prevents chaos on the Tyro sub-band with such relaxed rules?***

3.48 The answer: the same thing that is already working. Probably even before the 1984 agreement between the Commission and the American Radio Relay League (ARRL), licensed amateur veterans

have helped the Commission with repeater coordination and interference issues.

3.49 Our self management works. The "track record" is so good the Petition asks local licensees for more. Sixty-four of the new repeater channels require committee coordination. All ninety-nine channels have some local committee oversight. The local advanced licensees and their committees provide primary management regarding interference, permissible communication and pecuniary interest issues. They will be empowered by the local Amateur Licensees to help keep our vision and goals constructive, even uplifting.

#### ***Why This Spectrum?***

3.50 This slice of spectrum is innately suited to local use. It readily supports both simplex and repeater use in the same radios. There is little chance of interfering with communications beyond the local area. There is very little activity on the suggested Tyro spectrum. So, new repeaters will perturb few users. Further, a wide variety of both new and retired equipment is available for this band.

#### ***Forcing issues loom for current 70 cm repeaters.***

3.51 Primary licensees, like wind profiling radar (448-450MHz), will become a bigger issue as Weather Service and other plans materialize. Today, several Denver area repeaters complete with a 12 kilowatt wind pro-filer. If the interference gets worse, the radar licensee will not need to increase power to win. Interfering hams will be forced to move.

***More than CERT and ARES make this Sub-band vital.***

3.52 To avoid future conflict on this band, the Petition asks the Commission to insure our primary use of 430-440 MHz. This is the portion of our 70 cm band available to Amateur Radio in all three Regions of the world. For example, it is a primary place for international moon-bounce experiments, Internet connections and, amateur satellite communications. World wide, Hams talk to the Astronauts here.

***With Muted Voice, Technology and Culture Solicit Change***

3.53 Returning to a prior allusion, today's technology entwinement in culture does beg subtle change. Here are three topics coupling Amateur Radio and Humankind's increased dependence on technology:

- 1) peak emergency communication demand,*
- 2) technological compartmentalization and,*
- 3) equity of rural technology disparity.*

***Peak Communication Demand***

3.54 To the general public, this is probably the most obvious ham radio contribution. Much is reported about insecurity in both consumer-oriented and public safety communications systems. This vulnerability was demonstrated on September 11, 2001 in New York and again in New Orleans with Hurricane Katrina. Power failures cut off

the Internet. Debris damaged infrastructure. The remaining capacity was "jammed" with desperate calls. In these examples and hundreds less noted, hams provided significant help... life-saving help.

3.55 Amateur Radio prepares itself for this. The infrastructure is both diversified and distributed. It is less dependent on commercial connectivity. Thus, ham radio is more robust in the face of many kinds of disaster.

3.56 Most importantly, we are organized for emergencies. Emergency communications is at the core of who we are. This Petition intends to increase our fraction of the population. It intends to encourage us to build more of our kind of infrastructure. It intends to help us have more people organized and at-the-ready.

### ***Technological Compartmentalization***

3.57 Admittedly, my evidence for this obscure issue is anecdotal. For more than 30 years I have used a computer program testing engineering job applicants. It tests a broad spectrum of technical skills. I started using it to hire people when I did "turn-around" consulting. Then later, when I managed instrument development for the National Center for Atmospheric Research. I use it in my own business today.

3.58 The test evaluates more than skill level. It also points to strong and weak technical areas. Without exception, engineering graduates, who were also hams, always scored in the top decile. More than that, hams tend toward broad-spectrum "working knowledge" of many technical issues. In short, Amateur Radio was a much stronger

predictor of engineering potential than the applicant's *Alma Mater*.

3.59 Our hobby encourages diversity. It embraces many other human pursuits. Because electromagnetic force is a quarter of the known forces, the core of ham radio encompasses much of physical reality. People that know much about radio know important things about their universe.

3.60 As our culture has progressed, Humankind has become more specialized, communities of diverse experts, each with a specialized narrow focus. This is the "*yang*", without which, we dare not wander far from our caves. The counter poised "*yin*" is "cultural cacophony": each doing their own job well but, without regard to their performance in community. Before this topic lures me beyond our scope, I will make my small point, Amateur Radio is a good training ground for "big-picture people", people that can conduct the orchestra and turn discordance into a symphony.

### ***Rural Technology Disparity***

3.61 Economics restrict the penetration of infrastructure dependent technology into rural America. None of the ranches five miles and farther North of Howe, in Idaho's Little Lost River Valley, have cell phone service. The subscriber base is too thin for a provider to amortize their infrastructure. They might serve this valley if their costs were subsidized but, otherwise unlikely.

3.62 These ranchers must solve their problems using less modern technology... sans what is common in urban settings. If a ranch-hand injures himself working in the field, there is nobody to call. Some

try using FRS walkie-talkies or CB radios... but, despite the bubble-wrap's claim, the performance is rarely adequate.

3.63 In a gentle valley with mountains on either side, virtually every ham knows what to do. Pool their money and construct an interconnected ham repeater. Together, they could afford the few thousand dollars of fixed cost to build a system covering fifty miles of valley. Moreover, the East Idaho hams would probably help build it. Once built, they could use \$35 hand-held radios almost anywhere in the valley. With good equipment choices, the cost to operate the system is exceptionally low.

3.64 The Lost River story is replicated thousands of times in parts of rural America. So why is this not happening? To use a ham repeater one needs to be a ham. A license is required. The license requires a **test**. Ranchers, hunters, rock-climbers, skiers, farmers and more, do not see themselves as radio people... not enough to study technical radio issues toward **the test**... not initially.

3.65 With the Tyro license nearly all of them could become hams. While they might never own a soldering iron, they could become quite expert at the communications part of ham radio. Yes, "**appliance operators**" was the term; but now they see real value in ham radio. Now they are hams.

3.66 The existing ham community is likely to help them solve their communication isolation problem. The *quid pro quo* for current hams is another repeater. When they go to the "new valley" -- to hike, to hunt or fish -- they get to use the new repeater. These new

systems become ready to help in emergencies... for the hams, for CERT, for the neighbors, for public safety.

3.67 Some Tyros will be surprised to discover unexpected interest in advancing their technical skills. For sure, some of their kids will.

***The Tyro Petition asks local committees to do more than repeater coordination.***

3.68 It is virtually impossible to squander vacant spectrum, and the TyroSubBand is very vacant, especially in rural America. The reach of UHF is limited by natural law. The risk is contained. How the TyroSubBand is used in one location has little effect on other places. As long as the purpose of Amateur Radio is not violated, rules governing permitted communication should be locally flexible.

3.69 This Petition asks local repeater licensees, together with the local coordinating committee, to refine a rule-set for their repeater. Moreover, the local coordinating committees will, to some extent, also manage the simplex channels.

3.70 Such rules are bounded by Part 97 and all TyroSubBand channels (repeater or simplex) are "open" narrow band FM voice systems with a sub-audible data channel and a voice channel occasionally used for higher-speed data.

***Even the old-time hams will value the Tyro license.***

3.71 Your spouse, your kids, your siblings, your grandchildren and your friends will be more able to share your hobby. From the start, getting on-the-air will make it fun.



3.72 Yet, old hams know our hobby goes beyond fun. "Rubbing elbows" with this community exposes new recruits to novel ideas. It expands their vision. Concepts uncommon elsewhere are comprehensively pursued. Ham radio stimulates dormant aptitude. The Tyro license will attract new enthusiastic initiates. The size of ham radio will soon double and the goals of Part 97.1 will be more fully realized. The risk is that Tyros will dumb-down 2.25 MHz of 70cm spectrum monitored and controlled by "VEC tested" higher class licensees setting the rules for its local use.

3.73 The Tyro Petition can increase the scope and scale of independent emergency backup infrastructure. Ham repeaters will be found in more places. Over time, hams should be able to travel on interstate highways usually in contact with a repeater. They will be ready to help while they chat or just listen.

***A few economic benefits too.***

3.74 The Petition also affords low-risk opportunity for equipment suppliers. They want to add new radios, new repeaters and new networks. The Tyro license adds thousands of new customers. Already, there are reliable hand-held radios costing \$35 working on the Tyro sub-band. Because these channels are on world wide amateur spectrum, products developed for them have ubiquitous potential.

3.75 Moreover, because of the Commission's narrow-banding rules, there is a plethora of very expensive commercial radios headed for land-fill. Even by current offerings, the fundamental quality of decades old Mastr IIs, Mitreks and Micors is unsurpassed. Narrow

band kits are ready to resurrect these treasures, now, before their burial. Thus, the Tyro project continues another tradition. Hams recycle.

3.76 It is clear to all that look, hams already elevate community. And, just as clearly, every Amateur Radio Licensee reading this, has a place in this story. Every Girl Scout and Boy Scout has a place in this story. And every philanthropist willing to put a \$35 radio with a scout's new Tyro License, has a place in this story.

## **Section 4, RESOLVING AMBIGUITIES**

### ***Getting A Tyro Licensee***

4.1 A Tyro Class License will be issued to anyone not otherwise ineligible that has reached the age of eleven years and has passed an *"on-line"* test consisting of a few question dealing with radio etiquette and Amateur Radio Rules.

4.2 The on-line test shall be proctored by a current Amateur having a Technician or higher class license; the proctor is identified as part of the on-line test.

4.3 Further, an Amateur having a Technician or higher class license must agree to be the Tyro's mentor; the mentor is identified as part of the on-line test.

4.4 The proctor and mentor can be the same person.

### ***Tyro Class Use of The "TyroSubBand"***

4.5 While all Amateur Licensees may operate on the *TyroSubBand*, the Tyro Class License may not be used to transmit on frequencies outside the *TyroSubBand* (see 4.40 for *TyroSubBand* definition).

4.6 Traffic generated by a Tyro Licensee may be retransmitted on other Amateur bands by stations licensed to higher class licensees.

4.7 Repeated transmissions are limited to frequencies and modes permitted to the Amateur Licensee managing the process.

4.8 When a repeater is licensed to a club, the Trustee's license class is dispositive.

4.9 Subject to any limitations set forth herein, amateurs licensed by other countries may transmit on the *TyroSubBand* within the boundaries of the Commission's jurisdiction.

#### ***Regional Coordinating Committees***

4.10 As prescribed by Part 97.3(a)(22), one or more Committees will be formed to coordinate the *TyroSubBand*. Such Committees will coordinate activities on the *TyroSubBand* in their regions and will be charged with the following:

4.11 For repeaters using channels 1-64, Committees will coordinate channel and tone assignments for systems located in their region.

4.12 In conjunction with repeater licensees Committees will develop and published usage guidelines for coordinated repeaters in their region.

4.13 Committees will coordinate their activities with other Committees having overlapping interests.

4.14 For coordinated repeaters, Committees will assign unique ***indicators*** to be appended to repeater station identification (see Part 97.3(25)).

4.15 Within the “*voluntary noncommercial communication service*” guidelines established by Part 97.1(a), the Commission will give Committees deferential latitude in matters involving the permissible communication, pecuniary interest and cost-sharing plans; the Commission believes these local Committees are well suited to bring the stewardship judgments appropriate in their region without vacant

spectrum waste or thwarting priority communications.

4.16 On all the TyroSubBand's 99 channels, Committees will attempt local resolution of these issues: radio interference, permissible communication, pecuniary interest and, noncommercial cost-sharing.

4.17 When local resolution fails, the Commission will resolve any remaining issues.

4.18 Using an Internet website, Committees will publish this information for each coordinated repeater: location, antenna height above average terrain, effective radiated power, CTCSS OpenAccessCode, call sign and a unique identifier, as well as, the Internet location for the repeater's usage rules. If the repeater is not operational, that must also be noted (listed repeaters are assumed to be operational – see also 4.66).

4.19 These Committees may be paid for their efforts.

### ***TyroRadio Requirements***

4.20 Tyro Licensees may not be the Licensee responsible for a repeater or an auxiliary station.

4.21 Unsupervised Tyro Licensees must use TyroRadios which are restricted thusly:

4.22 *TyroRadios* must be configured to only use *TyroSubBand* channels.

4.23 *TyroRadios* may not transmit more than 20 Watts of power as measured at the transmitter's radio frequency output connector.

4.24 *TyroRadios* must be configured to meet the technical requirements described for the *TyroSubBand*.

4.25 *TyroRadios* must be controlled by an operator within immediate reach of the transmitter's main power and push-to-talk switches.

4.26 *TyroRadios* may be commercial off-the-shelf radios advertised as meeting *TyroRadio* specifications or radios certified by a higher class amateur licensee as meeting the *TyroRadio* specifications herein.

4.27 When adequately supervised by a higher class licensee, *Tyro* Licensees are not restricted by these *TyroRadio* limitations; such supervising licensees risk having some responsibility in such situations.

### ***Voice Priority***

4.28 An important goal of this proposal is nationwide interoperability. These standards facilitate communication among all users regardless of who manufactured the radio, which repeater is being used or where the repeater is located. To that end, common analog FM voice was chosen as the required standard for both the duplex and simplex channels. While digital transmissions are not precluded, all radios used on these channels must support common analog FM voice.

### ***Standardized Repeater Tones – OpenAccessCodes***

4.29 This *TyroSubBand* gives strong deference to voice repeater communication, all repeaters must repeat *VoiceChannel* traffic heard on its input frequency when such transmissions encode at least one of these three CTCSS tones: **67 Hz, 79.7 Hz, or 97.4 Hz**; these are the ***"OpenAccessCodes."***

4.30 This does not preclude other methods of "keying" the repeater, nor does it mean the repeater must perform functions other than repeating *VoiceChannel* traffic.

4.31 The *VoiceChannel* is defined at: 4.75

4.32 Simplex transmissions are not required to use *OpenAccessCodes*.

### ***UrgentCall***

4.33 A specific Dual Tone Multiple Frequency (DTMF) sequential keystroke combination is reserved for the purpose of activating otherwise muted receivers; this sequence is called *UrgentCall* herein; *UrgentCall* allows monitoring for urgent traffic without having to listening to mundane conversations.

4.34 The three keystroke combination of *\*#\** is used for this *UrgentCall* signal. This is easy to remember and achieve during exigent times because any four keystrokes alternating between *\** and *#* will generate the operative sequence (*\*##\** or *##\*\**).

4.35 This three keystroke combination is not likely to be unwittingly generated.

4.36 DTMF is virtually a standard feature on commercial radios. Encoder and decoder chips and kits are low-cost and common.

### ***OpenArchitecture***

4.37 Digital transmissions on this Tyro Sub-band must use "OpenArchitecture" techniques to encode digital traffic.

4.38 ***OpenArchitecture*** is technology available in the *public domain*; the detail of OpenArchitecture must be available such that anyone – *skilled in the art* – could compatibly use the technique... without an agreement and without paying a royalty.

### ***Station Identification***

4.39 As otherwise required, *TyroSubBand* stations may identify using voice, Morse Code or the same OpenArchitecture digital techniques used for traffic.

### ***TyroSubBand Channelization***

4.40 The ***TyroSubBand*** consists of 99, 12.5 kHz wide analog F.M. Channels numbered from 1 to 99. The channel center frequencies are in two slices of 70cm. One set ranges from 430.0125 to 430.9875 MHz. The other from 438.7625 to 439.9875 MHz.

4.41 Channel numbers 1 through 79 are repeater pairs; the repeater input frequencies are 9 MHz lower than the repeater output.

4.42 Channels 80 – 99 are simplex channels and are adjacent to the repeater output channels (438.7625–439.0000 MHz).

4.43 Stations may use repeater output channels for simplex if



they do not interfere with repeater traffic (this is *TalkAround*, in land mobile radio parlance).

4.44 The repeater input channels may not be used for simplex activity; these are duplex or half-duplex channels and are always used with their associated frequency 9 MHz up the band.

#### ***Technical Reasons for This Frequency Organization.***

4.45 The technical reasons for choosing these frequency combinations include the wider than expected duplex split. This makes duplexers smaller, cheaper, more stable, more portable, and more robust.

4.46 This transmit-to-receive split facilitates high "Q" receiver pass-bands (only 1.25 MHz wide). Since mobiles are permitted to use the repeater output frequencies for non interfering simplex operation, this scheme requires mobile transmit pass-bands to be 10 MHz; quite achievable for 70cm radios (easier for transmitters than receivers, retired surplus radios work well too).

4.47 This band width is easy for antennae; even high gain collinear dipoles can achieve this pass band with reasonable reflected power. Moreover, the *TyroSubBand* is at the third harmonic of our 2 meter band, nicely supporting 200cm/70cm dual-band antennae.

#### ***Channel Number - Frequency Association - Tolerance***

4.48 While this is counter-intuitive, as channel numbers increase the associated frequencies decrease.

4.49 Transmitted center frequencies must be within 900 Hz of the specified channel frequencies.

4.50 Again, channels numbered from 1 to 79 are associated with repeater pairs. So, channel number 1 has the output of a repeater transmitting on 439.9875 MHz traffic it received on 430.9875 MHz. Channel 2 repeaters are at T439.9750 R430.9750 MHz.

4.51 Again, as the channel numbers increment, their associated frequencies decrement by 12,500 Hz until the last repeater pair (channel 79) at T439.0125 R430.0125 is reached.

4.52 At 439.0000 MHz simplex only channels begin with channel 80. They too decrement 12,500 Hz in frequency as the channel numbers increment. The last simplex channel is 99; it is centered at 438.7625 MHz.

### ***F.M. Modulation Scheme***

4.53 Emissions on all 99 channels are limited to 11K00F9W or 11K00G9W. While either angle modulation may be used to generate the transmitted signal, they must be indistinguishable from 11K00F9W emissions.

4.54 The permitted modulation deviation from the channel's center frequency is a total of plus or minus 2500 Hz.

4.55 Voice transmissions must be supported.

4.56 Data transmissions are allowed but must use ***open architecture*** techniques as described at 4.38

4.57 The maximum modulating frequency is 3000 Hz and the base-band audio energy must roll-off by enough to meet 11K00F9W emission requirements.

4.58 The minimum intentional modulating frequency is 40 Hz; the

base-band audio energy below 40 Hz must roll-off by at least 6 dB per octave. [This audio energy is restricted to facilitate automatic receiver frequency tracking.]

### ***Audio Base-Band Divided Into Two Channels***

4.59 On all 99 radio frequency channels (duplex pairs and simplex) the base-band audio is bifurcated into pass-bands for "*sub-audible*" audio and "*audible*" audio.

4.60 Base-band audio frequencies from 40-to-200 Hz (*sub-audible*) are called the "***ToneChannel***" and,

4.61 base-band audio frequencies from 300-to-3000 Hz (*audible*) are called the "***VoiceChannel***".

4.62 The audio frequency band from 200-to-300 Hz is a guard-band protecting the *VoiceChannel* and *ToneChannel* from each other;

4.63 the *VoiceChannel* must roll-off its audio energy below 300 Hz by at least 24 dB per octave;

4,64 likewise, the *ToneChannel* must roll-off its audio energy above 200 Hz by at least 24 dB per octave.

### ***The ToneChannel***

4.65 The *ToneChannel* is reserved for Continuous Tone Coded Squelch Systems (CTCSS) and slow data.

4.66 Repeaters must respond by repeating input voice traffic when any one of the *OpenAccessCodes* accompany the voice; these are sinusoidal CTCSS tones of **67 Hz, 79.7 Hz or 97.4 Hz**;

4.67 their frequency tolerance is: plus or minus 0.5 Hz. [These tones are chosen because they can be modulated to carry data with little potential voice interference and they are less likely to interact with 50 or 60 Hz power-line harmonics.]

4.68 The *ToneChannel* may also be used for slow data traffic so long as its audio energy is limited beyond the *ToneChannel*'s 40-to-200 Hz pass-band and the data coding scheme is *OpenArchitecture*.

4.69 The audio response in the *ToneChannel* must be flat within 3 dB.

4.70 Frequency deviation in the *ToneChannel* must be between 250 and 400 Hz.

4.71 [Transmitting data in a tone channel has become common; E.F. Johnson's trunking and Motorola's digital squelch have used similar techniques for decades.]

4.72 Repeaters may respond to other tones or *OpenArchitecture* data within the *ToneChannel* pass-band, in addition to the required *OpenAccessCode*.

4.73 The *ToneChannel* may be used to control repeaters or other kinds of stations.

4.74 At the discretion of the repeater licensee, any *ToneChannel* traffic may be repeated, reformatted, replaced or ignored at the repeater output frequency.

### ***The VoiceChannel***

4.75 Faithful retransmission of human voice is the *VoiceChannel* priority; it must carry human voice using common analog frequency

modulation; unless the voice traffic violates the repeater licensee's guidelines or the Commission's rules, the content of such transmissions must be repeated unaltered.

4.76 When transmitting voice, the *VoiceChannel* audio must be shaped to within 3 dB of the standard 6 dB per octave pre-emphasis slope.

4.77 The voice priority requirement does not preclude using the *VoiceChannel* for other traffic so long as its audio energy is limited to the 300-to-3000 Hz pass-band and the encoding used is *OpenArchitecture*.

4.78 *VoiceChannel* transmission of tones or other data neither requires nor precludes pre-emphasis.

4.79 *VoiceChannel* deviation must not cause the total deviation to exceed plus or minus 2500 Hz when added to the *ToneChannel* deviation.

### ***Cross-Band Repeating and Linking***

4.80 Traffic received on the TyroSubBand may be repeated on other Amateur frequencies available to the repeating licensee, as long as the type of emission of the repeated traffic was converted to that appropriate to the frequency used; for example, voice traffic generated by Tyro licensees could be repeated on a 2 meter frequency – alone or in addition to the repeater's 70cm output – but, not on 14,090 kHz because voice is not allowed there. While voice is allowed on 14,160 kHz, the transmitting licensee would need an Extra Class License and FM voice traffic would need to be converted to single

sideband.

### ***Equipment Technical Compliance***

4.81 While the Commission will not adopt a "type acceptance" procedure for radios used on the TyroSubBand, Amateur Licensees may form Committees to review radio technical compliance to these rules.

4.82 Such a Committee may test both commercial and Amateur constructed or modified radios... issuing a recommendation, an approval or a disapproval, as the Committee sees fit.

4.83 While not required, constructors or modifiers may supply radios for approval.

4.84 Committees may obtain test radios using other free-market alternatives.

4.85 Committees may publish their findings.

4.86 Committees may involve the Commission when they deem it appropriate.

4.87 These Committees may be paid for their efforts.

Respectfully submitted,

by: Gary A. Hampton